OFFICIAL COPY.

Report of Dr. L. W. Darra Mair to the Local Government Board upon the Sanitary Circumstances and Administration of the Urban District of Gainsborough, with special reference to the prevalence of Fever therein.

RICHD. THORNE THORNE,
Medical Officer,
June 14th, 1899.

THE Board having observed, from the Returns of the Registrar-General for the quarter ended the 31st of March, 1898, that 5 deaths from "fever" (presumably enteric fever), had been registered in the Gainsborough Urban District, entered into correspondence with the District Council with a view of obtaining information as to the character of the fever prevalence and as to the steps taken to investigate its origin and to stay its spread. Having failed to secure the information thus sought (the special report of the Medical Officer of Health dealt only with scarlatina, which had caused one death during the period named), and having in mind the unsatisfactory administration of the district and its insanitary condition when visited by Dr. Fletcher in connection with the Cholera Survey in 1894, the Board deemed it advisable to direct local inquiry to be made by one of their medical inspectors. I was instructed to make the necessary inquiry, and for that purpose visited the district on several occasions in September and October.

GENERAL DESCRIPTION.

The Urban District of Gainsborough covers an area of 2,118 acres, and is situated on the right or, in this locality, the eastern bank of the River Trent, about 20 miles from its junction with the Humber. The greater portion of the district is of a rural character and is considerably elevated, but the populated portion—the town of Gainsborough—is situated in the valley of the river, and is almost entirely confined to a low-lying area of about 540 acres, bounded to the west by the river and to the east by the Great Central Railway. The river, which is tidal, forms here the boundary between the counties of Lincolnshire, to which Gainsborough belongs, and of Nottinghamshire. "It is swept at spring tides by a bore, locally known as the 'Eygre'; the inflowing water, rising to a considerable height and advancing like a wall, rushes with a loud noise swiftly up the bed of the river, sweeping all before it that has not been properly secured, and scouring up the mud in the channel and on the banks, increasing in this way the usual turbidity of the water."* The tide is said to flow for two hours and to ebb for ten in every twelve hours.

Geologically, the district is on the New Red or Keuper Marl, overlying, at over 700 feet, the New Red Sandstone. In the town the marl is covered with alluvium of varying depth.

* Dr. Bruce Low's report to the Local Government Board on the River Trent : 1893.

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At the census of 1881 the population numbered 10,939, and at that of 1891, 14,346. The Medical Officer of Health estimated, in his annual report for 1897, that the population during that year was 19,540. This figure, however, there is reason to believe, was too high. The number of occupied houses at the end of September 1898 was 3,830, according to a return from the rate-books which was made for the purposes of this report; and, assuming that the average number of occupants per house was much the same as it was shown to be at the last two censuses, namely, 4·8, it would appear that the population was, at the middle of 1898, some 18,000. The rateable value is £66,106, and the assessable value for general purposes £55,142. The district is divided into three wards—North, Central, and South.

Gainsborough is a manufacturing town, the principal industry being the manufacture of engines, boilers, and agricultural machines. Other considerable industries are the preparation of malt, and the manufacture of oil and cake from seed. Many years ago, before railways were constructed, a large river trade was carried on, for Gainsborough was the principal transhipping place for goods of all kinds *en route* from the sea to towns, situated on the Trent and its tributaries, in Nottinghamshire, Derbyshire, and Staffordshire. The advent of railways diverted this trade, but the Britannia Machine Works, which now give employment to some 3,500 men in the town, have rapidly developed, and have replaced the trade lost through discontinuance of the river traffic.

Sanitary Circumstances.

Dwellings.—The majority of the houses are occupied by persons of the working class. In the older and more central parts of the town there are many courts and alleys, known locally as "yards," in which houses are densely crowded together. Passing along Lord Street, Market Street, and Spring Gardens; along Church Street, Silver Street, and Bridge Street, as far south as the bridge over the River Trent; and along Back Street and Beaumont Street to Southolme; "yards" are to be found at intervals for the most part of a few paces. Commonly, a "yard" is reached by an arched opening from one or other of the above-named streets, and it consists, in many cases, of but a single row of houses facing a narrow passage which separates such row from the rear of a similar row of houses. In other cases, houses face the passage or "yard" on both sides; or perhaps the "yard" may be very irregular, intricately winding; sometimes it will lead through another archway to an inner yard of the same description. Occasionally a "yard" may be in the nature of a square, with houses on three or four sides of an open space of some size. But whatever the precise arrangement may be, it is very rare to find any through ventilation of houses in these "yards;" where something of the kind does exist it is generally by provision of a small grating or window in the back wall of a house Some of the "yards" communicate with a street at either end, and many of these are used by foot-passengers as the readiest means of transit from one street to another; but a considerable number of "yards" communicate with one street only. As regards dwellings in "yards," therefore, deficiency of light and ventilation is common, while the circulation of air about such houses is much impeded.

The houses in these "yards" are built for the most part of brick, although some are constructed of timber. Numbers of them appeared to be so damp or dilapidated from age and neglect as to be unfit for human habitation; many, indeed, are at the present time unoccupied, owing to the emigration of the tenants to houses recently built towards the outskirts of the town. The rate-books show that some 320 houses in the town were unoccupied at the end of September 1898, the bulk of which are said to be in the "yards" referred to.

Of more recent erection than the dwellings just described are many houses which, though not arranged in "yards," are nevertheless much crowded together. As examples, Britannia Cottages and Blackburn Buildings may be mentioned. These houses, and others similar to them, are usually built upon rectangularly shaped plots of ground, in such a manner that the whole surface is in each

instance occupied by dwellings and their outside offices, with the exception of a back yard of very limited area in connection with each dwelling, and a narrow passage of varying width—termed locally a "tenfoot"—which traverses the rears of each row of cottages on a given plot. These houses, some of which, it is said, were erected with the sanction of the late Local Board, have through ventilation, it is true, but the density of such property on area is so exceptional that (especially when combined with the dry method of refuse disposal to be presently described), it cannot fail to be prejudicial to the health of the inhabitants.

Still more recently erected dwellings do not usually possess defects of the sort above described, and many are now being built in well-arranged streets, with parallel "tenfoots" at the backs of the houses; and although the back-yard attached to each dwelling is limited, there is, nevertheless, adequate open space, as a rule, between and at either end of these streets. In some cases, instead of a "tenfoot" at the back, passages from the street to the back premises are provided between alternate houses. Many houses of this description are, however, said to be "jerry-built," and the almost universal practice is to erect them directly on the soil without concrete or other similar covering of the site.

House and Yard Drainage.—The back-yards of the more recently built dwellings are for the most part well-paved with blue bricks, or asphalt, and are drained to trapped gullies. The drains are said to be constructed of cement-jointed glazed earthenware pipes, and, as a rule, appear to be fairly ventilated. No steps, however, have been taken, even in the houses most recently constructed, to ascertain that such drains were watertight when laid down, nor is there any disconnection by trap or otherwise between them and the public sewer. The "yards," on the other hand, are generally imperfectly paved with flagstones, many of which have sunk in places, or with cobble stones, or partly with both; but in some cases there is no paving except a narrow strip adjacent to the house entrances. These "yards" are drained by means of open gutters or channels leading to a common gully, over which, as a rule, is a tap from which the water supply of all the houses in the "yard" is obtained. It was common to see slop water lying in pools about these "yards," in the crevices of the cobbles, in depressions of the flagstones and open channels, or about the gullies, owing to obstruction in the latter or in the drains connected with them. Little is known as to the construction of the underground drains leading from these "yards" to the sewers.

Excrement and Refuse Disposal.—Except as regards the more recently constructed dwellings, excrement and refuse are disposed of mainly by means of midden-privies. I am informed that, since 1896, all new houses sanctioned by the District Council have been provided with water-closets, and those that I saw seemed to be efficient and provided with adequate flushing arrangements. For most of the other houses, the common arrangement consists of a brick midden, locally called an ashpit, provided with one or more small doors and roofed with slate; and connected at either end with a privy, so constructed that the floor of the latter slopes towards the former. The middens are, as a rule, of enormous dimensions, some measuring as much as 15 ft. by 5 ft., or even 10 to 12 feet square, and are so constructed that the floor is usually considerably below the level of the adjoining ground, while it is uncommon for this floor to be paved, or for the brick sides to be faced with cement or otherwise secured against leakage. Commonly each house is provided with a separate privy adjoining a midden shared by two houses. The result of this arrangement is that a large portion of the area in the immediate vicinity of these dwellings is occupied by these structures, with resulting nuisance from soil and air pollution, especially in those instances already referred to where houses are densely packed together.

In a "yard" it is usual to find a midden with two or more privies for the use of all the houses. Some of the "yard" privies have no communication with middens, and discharge each to an underground receptacle. In many of the "yards" there is considerable insufficiency of closet accommodation, but the position of these structures in the "yards" is, commonly, very objectionable. Frequently they are within four or five feet of a dwelling, and in some

cases they are in actual contact with it. As examples of the latter, may be mentioned :—

Drust's Yard.—A midden, 10 ft. by 10 ft., and three privies are in contact with the back wall common to two dwelling houses. This wall is damp, and forms, inside, a portion of the larder in one of the houses. In both houses offensive smells are said to be noted at times.

Long Row.—A corner house, No. 12, is in contact with a midden and two privies. The wall inside the dwelling is damp and forms part of a cupboard where food is kept. The tenant complained that the stench in the cupboard was at times abominable.

Chapel Yard.—A house occupied by Mrs. H—— is very damp, and adjoins on one side a midden and three privies, the former of which contained a quantity of water. A stable also adjoins this house.

Many of the middens seen during my inspection were over full. Some contained water, and, in a few cases, their fluid contents were observed to be leaking through the brickwork. Others, again, were much dilapidated, and in several instances the roofs were seen to be imperfect. Scavengers under contract with the Council are supposed to empty and cleanse these structures, during the night-time, at least once in three months, and although several people complained that this interval was often prolonged, in some cases to nine or even twelve months, most concurred that there had been considerable improvement recently. Fouling of the adjacent ground evidently takes place during the process of emptying of middens, in spite of prohibition of this in the contracts. In no case, it is said, is it now necessary to remove the contents of these receptacles through a dwelling house.

It appears that the privy-midden system supplies accommodation for 2,455 houses, 1,060 of which possess separate privies.

But in 1895 the Council, following the advice of the Surveyor and of a deputation of their number which visited various towns in the Midlands, authorised the experimental adoption of the Goux system of movable receptacles on a limited scale. The Surveyor, in a recent report on the result of this trial, states that there are some 205 closets of this description. A wooden pail, lined with "shoddy" as the absorbent material, is provided once a week during the daytime by a scavenger, who at the same time removes the one in use to his depôt. This system appeared to be attended to regularly.

In other houses—about 100 it is said—a pail system is in use, the receptacles, which in these cases are constructed of galvanized iron, being emptied once a week during the night-time by a contractor, but not removed.

Other houses, again, in a few of the "yards," are provided with trough closets with automatic flushing apparatus.

All other dwellings, some 1,300 in number, are said to be served by water-closets.

As regards the majority of those houses where privies do not exist the midden has been abolished and replaced by movable ash bins for weekly collections of house refuse.

In regard to houses adjoining the river, refuse is commonly cast into the water or upon the river bank. Several soil pipes discharge directly into the river: a privy outlet, covered with sacking, was observed, with the privy-wall between it and the water streaked with filth, and several heaps of refuse were seen on the mud foreshore waiting for a high tide to remove them. In one instance, there was observed upon the top of an incline sloping towards the river an accumulation composed of house refuse and the contents of privies, which, it is said, could only be swept away on the occasion of very high tides. This nuisance, which was extremely offensive, was eight feet from an entrance to a common lodging house, and adjoined a warehouse.

Sewerage.—A scheme of sewers for the town was designed in 1855, and was carried out and completed in 1857. To what extent the original scheme, of which the plans are in existence now, was adhered to is not exactly known : in some cases, it is said, sewers have not been found where indicated. The plans, moreover, show the course of certain brick sewers which were in use antecedent

to 1855, and while some of these are known to exist to this day, others are said to have been abolished. Subject to this qualification there is no evidence that, beyond one considerable and a few trifling alterations, the present system is other than is indicated by these plans of 40 years ago.

The system consists of 10 apparently distinct systems of sewers which traverse the town from east to west and ultimately discharge into the river. The sewers are said to be of many sizes, with very varying gradients. Those which were newly provided in 1855-57 were constructed, I am told, of earthenware pipes jointed with clay, and they follow, in the main, the lines of the principal streets ; but the more ancient sewers are in many places underneath or closely adjoin the basements of houses.

For instance, in Pillard House Lane, a brick sewer, $4\frac{1}{2}$ ft. by $2\frac{1}{4}$ ft., near the outfall, lies under some houses, and led to complaint by the occupants both on account of the smell in the houses and on account of the incursion of rats. As a remedial measure, a ventilating shaft has recently been erected there. I had an opportunity of examining a considerable length of this sewer, and it was found to contain a large amount of deposit, varying in depth from 12 to 24 inches.

There is no system for the ventilation of the sewers, all manholes or lampholes that were originally provided having been closed some years ago. Ventilating shafts are common in connection with the house drains of new houses, and as there are no traps intervening between drains and sewers they may act as sewer outlets ; but in the older parts of the town nothing of this sort appears to exist. Periodical cleansing of sewers by flushing is apparently not practised except in the new parts of the town, where it is said to be done every two or three months. In Church Street there is a flushing chamber supplied with town water, which is set to discharge at short intervals.

The outfalls discharge into the river below the normal low water level, and are tide-locked for considerable periods of time each day. At ordinary high tides, the sewers for some distance from their outfalls are also at a lower level than that of the river. In order to prevent incursion of river water, penstocks have been provided at six of the outfalls, and one of the latter has also a large storage chamber in which sewage may accumulate while the penstock is in use. But the penstocks are said to be used only when, from the state of the river, it is anticipated that water might be forced up some surface gully, as indeed has happened on more than one occasion. It has even been necessary to pump sewage from the town side of one of the penstocks to prevent it overflowing into the roadway. Some of the outfalls, moreover, are of altogether inadequate capacity, in view of the size and number of the various sewers converging to them. For example, that near Hickman Street consists of a 9-in. pipe, which is stated by the Surveyor to pass "through Hickman Street to the end of Torr Street, picking up a 9-in. pipe in Victoria Street, a 12-in. pipe in Hawksworth Street, and a 9-in. pipe from Albert Terrace, which latter is supposed to lie under a block of houses between Etherington Street and corner of Victoria Street. Three yards also drain into this sewer by 6-in. pipes laid about two years ago."

Work during recent years in connection with the extension and alteration of the sewer system is said to have been done on modern principles. A new outfall sewer was being constructed at the time of my inspection in the northern part of the town in connection with the increased building going on there. It is to replace one of insufficient size made some 15 years ago. This and the several sewers converging to it are said to be constructed with watertight joints and with proper fall. A second outfall sewer, said to be of similar construction, was provided a few years ago in order to divert the sewage from the original outfall which traversed an open area required for building purposes. The old outfall sewer, however, a pipe 15 in. in diameter and some 500 yards in length, was merely abandoned, and now lies beneath several newly-erected dwellings.

Notwithstanding the above extensions and a few other minor alterations, it is abundantly clear that the existing sewer system generally is not only inadequate in itself to the needs of the town but is also dangerously defective. In consequence both of the physical conditions associated with the outfalls and of the construction and arrangements of the sewers themselves, sewage must frequently accumulate and head back in them, and also, no doubt, in the house

drains connected with them. This, indeed, has occurred to an extent sufficient to cause visible overflow through surface inlets in house drains; and in this connection it is important to note that for every occasion on which it occurs to this extent, the occasions on which it does so to an extent short only of visible overflow are probably much more numerous. No doubt, also, whether it is visible or invisible, this heading back of sewage in sewers and in house drains involves the escape of their contents into the soil around them, and must aggravate in a serious manner that soil pollution which is so common in this town.

Water Supply.—The water supply of the district is under the control of the District Council, the water-undertaking having been purchased from a company in 1871, for £11,000. The works are situated at the southern end of the town near the River Trent, and water, derived partly from the river, partly from a well, is pumped from them through a rising main, 8 inches in diameter, to a high level reservoir at Summer Hill, about a mile distant. The rising main traverses the town and supplies distributing mains on the way, so that surplus water only passes into the reservoir, which is 103 feet above the works. Some thirty houses are at a higher level than this, and the requisite pressure for their supply is obtained by means of a "stand-pipe" on the rising main near the reservoir.

The above arrangements are, however, in course of alteration. A new rising main, 14 inches in diameter, has been laid down, which will, in supersession of the 8-inch rising main, convey water direct from the works to the above reservoir, and also to another of larger capacity alongside it, as well as to a tank at the top of a water tower. From these receptacles water will gravitate through the old rising main to supply the town. The capacity of the old reservoir is 656,176 gallons, and that of the new one is 1,004,350 gallons, while that of the tank in the water tower is 6,626 gallons. The construction of the new reservoir has been completed. Both it and the old one are elevated considerably above the level of the roadway adjoining, and both are uncovered. The new water tower is also practically complete.*

Reverting to the waterworks themselves near the river, it appears that when the late Local Board purchased the undertaking, the supply consisted entirely of water derived from the river. As that source is still made use of, it is necessary to trace the course of this water from the river to the town. The intake from the river is situated at the Great Northern Railway Company's depôt, about 360 feet only above the nearest sewage outfall from the town, the water gravitating into an underground tank constructed, it is said, of brick and cement, close to the river. From this tank, water is pumped to the works and passes into a subsiding tank, 80 ft. by 50 ft. by 12½ ft. deep,† whence it is drawn off from the surface by floating arms to two filtering tanks, each of which measures 50 ft. by 56 ft. by 9 ft. deep. Here it passes continuously through 2 ft. 4 in. of sand of varying degrees of fineness and 12 inches of coarse gravel, to channels on the floor of the tanks, whence it is conveyed to the "pure water" tank, the inlet to which, for the filtered water, is at its bottom. From the latter tank, which measures 70 ft. by 50 ft. by 7 ft. deep, water gravitates again to a pumping well adjoining the engine house, whence it is pumped into the rising main. All the tanks in the works are uncovered.

Doubts as to the purity of the river water having been entertained, the late Local Board determined in 1885 to drive a bore-hole on the site of the waterworks through the marls into the sandstone rock underlying them, Mr. Dalton, Mr. De Rance, and other Engineers being of opinion that a plentiful supply of pure soft water would be obtained from this source. A loan for this work was sanctioned by the Board. The sandstone rock proved to be at a greater depth than had been anticipated, but eventually all difficulties were overcome and the present bore-hole became established. It extends to a depth of 1,351 feet 7 inches from the surface, of which 725 feet are in

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* The new reservoir and water tower have been formally opened since the above was written.

† Up to the date of the commencement of the other new works, described below, there was another subsiding tank of the same size.

the marl and the remainder in the sandstone, and is lined with cast-iron tubes to a depth of 755 feet. At the surface there is a "well" 27 feet in depth, cased in iron cylinders 8 to 9 feet in diameter, and from that point downwards there are cast-iron tubes of a diameter diminishing from 19 inches at the top of the bore to 12½ inches at a spot about 30 feet below the top of the sandstone; beyond this there is an unlined bore-hole, 10 inches in diameter, in the sandstone rock itself. In order to exclude surface water the tubes are surrounded with cement concrete to a depth of 27 feet below the bottom of the "well" above mentioned, and are telescoped for 22 feet where changes of size occur. When first constructed there was serious incursion of water from the superficial soil, which, it is said, has now been overcome. A double-action pump, 11½ inches in diameter, with a four-foot stroke, is suspended within the bore, at a depth of 212 feet from the surface. Originally, it was single in action, and was suspended nearer the surface, but it has been altered to its present form in order to increase the yield of water, although even now it has to be worked night and day without intermission, at the rate of 12 strokes per minute, lifting, when in good order, 20,000 gallons every hour. It is, however, shortly to be replaced by another pump, with a capacity of 36,700 gallons per hour. The water from this well is pumped direct into the "pure water" tank above described, and thence *viâ* the pumping well already referred to into the mains without any preliminary treatment. The rest level of the water when the bore was first brought into use was about 6 feet from the surface; it is consequently an artesian well. The water is said to be derived from an outcrop of sandstone situated at its nearest point, about seven miles away, and extending, according to a report by Mr. Stooke, of Shrewsbury, from Retford and Worksop in the south to Tickhill and Bawtry in the north. The anticipation that the water would be soft has unfortunately not been realised, its hardness being on the contrary excessive. (*See* Appendix III.)

Water derived from this source has been regularly supplied to the town since 1889, but Mr. Hopthrow, the manager at the works, states that the well water has at no time been sufficient to meet all requirements; that it has been necessary almost always to supplement the supply daily by water derived from the river. The amount of the latter used, as a rule, is quite unknown, for the Council have provided no means of gauging the volume of water pumped from the sandstone, but the surveyor has endeavoured to ascertain for me the approximate amount of river water used, and he states that it varies from 25,000 to 37,000 gallons a day. It is the aim of the manager to keep the water level in the pure-water tank at a certain point, which experience has taught him to be necessary. When there is difficulty in keeping the water up to this level by pumping from the well in the sandstone, river water is introduced. Beyond the daily use of the river water, as above described, there are occasions when the machinery connected with the sandstone well breaks down, or for some reason requires repair, in which case it is necessary to supply the town with river water entirely. During 1897 the town was so supplied on 71 days, 36 of which were consecutive. On these occasions, owing to the restricted area of the filtering beds, the river water requires to be hurried through them as rapidly as possible; so much so that when drawn off in the town the water is said to contain much suspended matter and sometimes even visible living organisms. Indeed, when this supply from the river is found to be necessary, bills are posted warning householders to boil the water before using it for drinking purposes, and the town-crier at the same time announces in the streets that river water is being used, and calls attention to the advice as to boiling.

The District Council are, however, endeavouring to make it unnecessary to use river water at all. In order to increase the yield of the existing artesian well it was proposed to sink a well beside the present bore-hole, but of larger capacity, and to connect the two. The sanction of the Board was obtained for a loan for this work, but ultimately the scheme was abandoned and it was decided to sink an entirely new and distinct bore-hole. The sanction of the Board was also obtained for the latter, and the bore-hole, which is being sunk on the site of one of the subsiding tanks, some 120 feet distant from the old bore, will be 1,450 feet deep, and will be lined with iron tubes to a depth of 775 feet, or 50 feet below the surface of the sandstone. The diameter of the tubes will

diminish from 30 inches at the top to 18 inches at the bottom, while the unlined bore in the sandstone will also be 18 inches in diameter. The work of sinking this bore-hole has been interfered with by an unfortunate accident. In April, 1897, when over 700 feet had been sunk, the boring tool and its accessories became detached from the gear above, and in spite, it is said, of constant efforts, it had not been recovered at the date of my inspection. The contractor, however, is said to be confident that it will be recovered before long, and that thereafter the completion of the well will not be a long process, as the more difficult boring work has already been accomplished. When this new well is completed, it is anticipated that, in consequence of the greater diameter of the bore, it will be possible to obtain a supply fully sufficient for the needs of the town, and that it can be supplemented, if necessary, or replaced, in times of break-down or stoppage for necessary repairs of machinery, by water derived from the existing bore.

Slaughterhouses: Cowsheds and Milkshops: Bakehouses.—There are 16 slaughterhouses, 16 cowsheds, 5 milkshops, and 11 bakehouses. The majority of slaughterhouses and cowsheds are either structurally bad or showed evidence of neglect of ordinary cleanliness. One cowshed, said to have been erected at the beginning of 1898, near Sandsfield Lane, is a structure built of rough, tarred timber, unprovided with any means of lighting or ventilation beyond that afforded by the doors. At another, many tons of manure had been allowed to accumulate, and drainage from this manure had collected on the ground near to it in pools. Many of the slaughterhouses are in densely-populated portions of the town, such as "yards," and nuisances in connection with them were very common. Some of the bakehouses are satisfactory, but others are in objectionable situations, one in particular being in a "yard" and almost surrounded by privy-middens.

Sanitary Administration.

The District is under the control of an Urban District Council which consists of 18 members, and meets once a month. There are three Committees, the members of which meet a few days before the Council, and it is their duty to make recommendations to the Council.

Adoptive Acts, Bye-laws and Regulations.—The Public Health Acts Amendment Act, 1890, was adopted in February, 1891, but neither the Infectious Disease (Notification) Act, 1889, nor the Infectious Disease (Prevention) Act, 1890, is yet in force. More than one attempt has been made to introduce the former, but without success. The last was made at the end of 1897, following a report by the Medical Officer of Health, when one of the principal objections to its adoption appeared to be the ill-founded fear that the locality of infectious cases would become publicly known and so lead to interference with the business of tradesmen.

The following list shows the bye-laws which are in force, with the date on which they were allowed by the Board :—

New streets and buildings	August 8th, 1882.
Prevention of nuisances and keeping of animals ...	June 10th, 1889.
Regulation of common lodging houses	June 10th, 1889.
Regulation of the market	June 10th, 1889.
Regulation of slaughterhouses	June 10th, 1889.

Regulations respecting dairies, cowsheds, and milkshops have also been in force since March 5th, 1888.

The bye-laws dealing with new streets and buildings are in general accord with the Board's model series of that time, though there are some important modifications. For example, it is not compulsory to cover the site of new houses with a layer of concrete or other impervious material. There is every reason to believe, too, that there has been considerable neglect in administering these bye-laws. No sufficient steps, for instance, are taken to enforce the bye-law requiring house drains to be laid with watertight joints. In fact, the surveyor informed me that it is impossible for him to inspect

houses during their construction, and that his usual practice is to inspect them when completed with a view to certifying them as ready for habitation. The bye-laws in respect of common lodging houses appear also not to be strictly observed. Three such houses are now in use, and while one of them appeared to be unfit for habitation, another was overcrowded.

With the exception of one representation recently made by the Medical Officer of Health condemning several houses in a "yard" as unfit for habitation, no action has yet been taken in the district under the Housing of the Working Classes Act, 1890. The houses in question were unoccupied at the time of my inspection, but no closing order had been obtained in regard of them.

Scavenging.—The District Council contract with two persons to remove all "house refuse, night-soil, filth, dust, ashes, and rubbish" from houses in the district. The contractors are not, however, required to empty any "subterraneous vault." The district is divided into two sub-districts, and each contractor has one of these areas allotted to him. Each is required "to make a round from house to house at least once in every three months, between 10 p.m. and 7 a.m., to remove all refuse without depositing it on the ground, and sprinkle each receptacle emptied with disinfectant supplied by the Council, and, further, to remove weekly during the daytime the contents of the dry-closet tubs on the Goux system, now being tried by the Council, for which purpose he is to provide a covered dray with closed sides." For the latter system the Council provide the tubs and the absorbent material (shoddy) for lining them. The contractor is required to remove the tubs to a depôt, cleanse and disinfect them there, and to "line" them with the shoddy. He is also required to immediately comply with any notice from the Inspector of Nuisances calling upon him to cleanse any receptacle, and if he fails so to comply within three days he is to submit to a fine. But the contractor is expressly told not to wait to receive such notice, and he further has to make a weekly return of receptacles cleansed by him. Upon the unsatisfactory manner in which the work of scavenging of middens is performed, I have already commented (*see* page 4). The remuneration of one contractor is at the rate of £552 per annum, and of the other £444 per annum, the respective amounts having been recently increased. The refuse is disposed of by the contractors to farmers in the neighbourhood, mainly, it is said, to those on the Nottinghamshire side of the river.

Hospital for Infectious Diseases.—The district possesses a hospital for Infectious Diseases, which was built out of a loan of £1,500 sanctioned in 1878. It is situated on a site south of the town, and comprises an administrative block, two separate ward pavilions, and a laundry building. The administrative block consists merely of a bed-room, living room, and kitchen. Each pavilion comprises one ward with space for four beds, and two separate rooms at one end intended for day and night accommodation for a nurse. The laundry building comprises a small laundry, a room for the ambulance, a room for the disinfector, and a mortuary. The ambulance is a small two-wheeled covered cart, in which it is impossible for a patient to lie down. The disinfecting apparatus consists of an iron box, the dimensions of which are $5\frac{1}{2}$ ft. by $2\frac{1}{2}$ ft. by $3\frac{1}{2}$ ft. high. It is heated underneath by several rows of open gas burners, while inside the box, within six inches of the lid, is a wire grating on which articles for disinfection are deposited. No bulky articles can therefore be dealt with in this box, and it is said that such things as mattresses are fumigated with sulphur in the mortuary. No record is kept of articles "disinfected" at the hospital, and on inquiry disinfection there appeared to be a rare occurrence.

Besides the above buildings, there is also on the hospital site, and distant from them a few feet, a "temporary" structure of tarred wood, consisting of two rooms, each measuring some 18 ft. by 18 ft. by $9\frac{1}{2}$ ft. high, and provided with six windows, each some 2 square feet in area.

No patients have been admitted to this hospital since 1888, when 35 cases o small-pox were treated there. It is said that no more than six patients were at one time accommodated in either of the two wards, or more than four or five in the "temporary" building, which was erected at that time.

During this small-pox outbreak the then Local Board issued a tariff setting forth the charges that would be made on account of patients treated at the hospital, and requiring a written guarantee from some responsible person that such charge in each instance would be paid. The charge per week demanded under this tariff, which still exists, varies from five to ten shillings for children under five, to £1 or £2 for persons of 12 years of age and upwards. (*See* Appendix II.)

A caretaker, who is the wife of a water inspector employed by the Council, is in charge of the hospital. For this duty she receives no remuneration, but is allowed 3*s.* 6*d.* per week during the winter months to provide fuel for airing the wards. She lives with her husband in the administrative block, and in her kitchen the sheets and blankets for the wards are kept. The interior of the hospital was, generally, in a clean condition, and had recently been painted and whitewashed, but the grounds immediately surrounding the buildings were in a very neglected condition.

The Medical Officer of Health is Mr. Horsley Wilkinson, M.B. (Vict.), who has been in office since July, 1897. His salary is £20 per annum, none of which is repaid out of county funds. He makes monthly reports to the Council on the mortality returns, but does not attend any meetings of that body or of the Sanitary Committee unless he is specially summoned. He had in this way attended three meetings since his appointment. He does not make systematic inspection of the district, and does not supervise the work of the inspector of nuisances, although occasionally he has drawn the latter official's attention to nuisances which he has observed in the course of his private practice in the town. He has made special reports on overcrowding, and on nuisances connected with privies, and he has made a representation under the Housing of the Working Classes Act, 1890, as to 13 houses unfit for human habitation.

The Inspector of Nuisances is Mr. Frederick Penny, who has been in office for some eight or nine years. His salary, which at first was £30, is now £50 per annum, none of which is repaid out of county funds. He holds no other paid public appointment. This officer, who has no special qualifications for sanitary work, is nearly 60 years of age, and took up inspector's work after his retirement from business as a cabinet maker. He makes no systematic inspection of the dwellings in the district, and his principal work appears to consist in supervising the work of the scavengers. Even in this, however, he appears to exercise little or no system; "he takes a walk round indiscriminately along the ten-foots to see if he can find any nuisances in the privies or closets." No note is made by him of these inspections, except as regards any midden or privy which may seem to him to require attention by the scavenger. His official daily journal is not used as such, and no record of complaints is kept. Cow-sheds, milkshops, and slaughterhouses are said to be inspected by him once a month, but bakehouses and workshops are not inspected. In the prevailing circumstances of Gainsborough, however, the proper supervision of the scavengers' work may be thought of as sufficient for even an energetic man's whole time services, and as leaving him little opportunity of dealing with nuisances, especially those of a recurring nature, or with structural and other defects in and about dwellings, such as should obtain the sustained attention of an Inspector of Nuisances. As a fact, nuisances abound in all parts of the district. Those resulting from privy middens, in consequence of their infrequent cleansing as well as of their defective structure, have already been mentioned. But, besides these, such nuisances as those arising from pig-keeping, offensive stables, manure accumulations, defective and frequently blocked house drains and gullies, defective sinks and rain-water pipes causing dampness in houses, and from imperfect paving in many of the yards, as well as nuisances occurring inside dwellings, were frequently observed during my visit.

The other officers employed by the Council are as follows:—The Clerk is Mr. D. M. Robbs, and his remuneration is £275 per annum. He is a solicitor in practice in the town, and holds other public appointments of a similar

character. The Surveyor is Mr. Henry Riley, with a salary of £175 per annum. This officer, who devotes his whole time to his work, seemed to be well acquainted with the sanitary needs of the town. He has been called upon to design and plan the new reservoir and water tower, as well as the new rising main, the new outfall sewer now under construction, and a large number of private streets, under the Private Street Works Act. He stated that these matters have involved so much work in connection with plans and apportionments, that he has been unable to attend to, what should be one of his most important routine duties, namely, the inspection of new houses in course of erection. He has reported upon the system of excrement disposal in use in the town, and recently in his third report on this subject, recommended the substitution of the water carriage system. He is provided with an assistant who is paid £52 per annum. Mr. Cuckson is the Inspector of Common Lodging Houses and Canal Boats, for which he is paid £3 3*s*. per annum ; but this officer is also Collector of Water Rates, with a salary of £85 per annum.

Steps taken for Prevention of Disease. — There is little, except of a negative description, to be said as to the steps taken by the District Council to check the spread of infectious disease. Their neglect to adopt the Infectious Disease (Notification) Act results in official ignorance as to the existence of disease, and this is aggravated by the further neglect to obtain information by those means which are adopted in many places to supplement the knowledge gained from the notification system. For example, in consequence of a special report of the Medical Officer of Health towards the end of 1897, the District Council decided to supply disinfectants, free of charge, to occupiers of houses invaded by infectious disease, and although my inquiries into cases of fever showed that the persons concerned had largely availed themselves of this free supply, by personal application at the offices of the Council, yet no record of such applications was made and consequently no advantage was taken of what should have been a direct source of information as to infected premises. Similarly, no attempt is made to obtain information systematically from schools.

Beyond the supply of disinfectants to those who apply for it, and the closure of schools on the occurrence of an epidemic, such as was necessary in 1897 in consequence of outbreaks of measles and scarlatina, little has been done in repression of disease. The Inspector of Nuisances is said to visit houses when he learns of the existence of infectious disease in them, but I am satisfied, from the information gained during the course of my inquiries, that such visit by him must be a rare occurrence. No information is given by the Council to school authorities regarding houses invaded with infectious disease; disinfection of houses or of infected articles is only done when special application is made to their officers ; and no steps are taken to prevent the deposit of infected matters in privies and middens. I found that in Gainsborough the almost universal method of disposing of typhoid discharges was in the midden, sometimes with, sometimes without, "disinfectant." Moreover, steps have not been taken to cleanse fever-infected middens, in spite sometimes, it was said, of repeated application to the Inspector of Nuisances. The neglect, too, of the Council to encourage the use of their hospital for the isolation of persons suffering from infectious disease, has been very deliberate.

Fever.

The following table A shows the number of deaths which have been ascribed to "fever" and diarrhœa, year by year, during the 10 years 1888–97, in the Gainsborough Urban District, together with the estimated population for each year. The latter figures have been arrived at from the census data and the return of inhabited houses made for me from the rate books. The number of deaths attributed to the respective diseases, has been ascertained from the local registrar's lists in possession of the Medical Officer of Health. It is to be

noted that "fever" is the term used by the Registrar-General to include typhus, enteric fever, and continued fever.

TABLE A.

Population (estimated) at middle of		Deaths ascribed to		
		"Fever."	Enteric Fever only.	Diarrhœa.
1888	13,320	3	3	9
1889	13,680	5	4	26
1890	14,050	5	4	13
1891	14,450	5	3	8
1892	14,910	3	2	7
1893	15,380	5	5	36
1894	15,880	2	2	13
1895	16,380	3	3	32
1896	16,900	2	2	11
1897	17,450	6	6	30
Total	152,400	39	34	185
1898	18,000	7*	7*	16*

* Registered during period ended October 1st.

The next table shows the mean annual death-rate per 100,000 living in Gainsborough from fever and from diarrhœa during the 10 years 1888–97; and, for purposes of comparison, similar rates in respect of England and Wales, and of the 33 Great Towns.

TABLE B.

1888 to 1897.	Death-rate per 100,000 inhabitants from	
	"Fever."	Diarrhœa.
Gainsborough	26	121
England and Wales	17	63
33 Great Towns	19	86

The first table indicates that, during the decade in question, the district has never been free from "fever" in any particular year, the figures showing a remarkably steady persistence of the disease; while the second table makes it clear that, broadly, there has been, in proportion to population, half as much more fatal "fever" in Gainsborough than in the country as a whole or in the 33 large cities and towns. The record as to diarrhœal diseases is even more unfavourable to Gainsborough, the proportional mortality there having been nearly double that of England and Wales. As regards the year 1898 up to October 1st, the deaths in Gainsborough ascribed to "fever" represent an annual rate of 52 per 100,000, a figure which is double that of the high mean of the town and treble that of the country as a whole, in the preceding 10 years. So that it would appear that Gainsborough has, for many years, suffered persistently from an excess of fever and of diarrhœal diseases, and that quite recently the excess of fever has been even greater than usual.

When I visited the town, I found that, owing to the absence of any system of notification, very little was known of the number of cases of fever of recent occurrence; indeed in some quarters doubt was expressed whether there had been an unusual amount of the disease. So great were the difficulties in obtaining information, that the necessity for limiting my inquiry as to fever to 1897 and 1898 speedily became obvious. Many of the medical practitioners of the town, having kept no record of cases under their care,

were unable to supply much information even as to this limited period. The District Nurses' Association, however, placed at my disposal the records of their nurses. These were supplemented by information in the possession of the Medical Officer of Health, and by that supplied by some of the local medical practitioners, so that, eventually, 62 cases were discovered as having occurred between the beginning of 1897 and the end of August 1898. It is unlikely that this number represents to the full the actual extent of fever during that time, but nevertheless the attack rate, based on the above data (2·0 per 1,000), is double the mean annual attack rate (1·03 per 1,000) of 50 towns, which possess the advantage of the Infectious Disease (Notification) Act, 1889.*

The following table shows the distribution of the 62 discovered fever cases during the various months in question, and the distribution of the houses invaded among the three wards of the town :—

TABLE C.

Number of Cases of "fever" discovered to have occurred.		Number of Houses invaded in			
		North Ward. (1,556 houses.)	Central Ward. (1,177 houses.)	South Ward. (1,097 houses.)	† The whole District. (3,830 houses.)
1897 January	2	—	—	2	2
„ February	1	1	—	—	1
„ March	—	—	—	—	—
„ April	1	—	—	1	1
„ May...	1	—	—	1	1
„ June	1	—	1	—	1
„ July	1	1	—	—	1
„ August	4	1	1	—	2
„ September	6	2	1	1	4
„ October	9	4	2	2	8
„ November	6	1	—	1	2
„ December	6	2	2	2	6
1898 January	8	1	4	2	7
„ February	3	—	1	—	1
„ March	6	1	2	1	4
„ April	2	—	—	—	—
„ May...	—	—	—	—	—
„ June	1	1	—	—	1
„ July	—	—	—	—	—
„ August	4	2	1	1	4
Totals	62	17	15	14	46

† *See* Appendix I. as to occupied houses in Wards.

From this table it would appear that there was a marked increase of "fever" during the autumn and winter months of the period under review, with slighter but persistent prevalence during most of the remaining months ; and also that the discovered cases occurred in all three wards to, relatively, an almost identical extent, indicating that all parts of the town probably suffered equally.

The disparity between the number of known cases (62) and the number of invaded houses(46) is very great and suggests that in many instances persons contracted the disease from a patient previously attacked in the same house. Investigations confirmed this, and also pointed to the transference of the disease in some instances from house to house. In a word, as many as 19, or 31 per cent. of the total number of attacks, were found to be traceable to previous cases, in consequence either of inefficient isolation or of careless and, probably, ignorant nursing ; for many of those who thus contracted the disease had been engaged in nursing and tending a relative or friend. Moreover, in two or three houses fever is alleged to have occurred during the tenancy of previous occupiers. In one house at least two such previous and separate occupiers are said to have been affected.

Inquiries failed to elicit that there was anything in common among the

* Dr. Thomson's Report to the Local Government on Persistence of Fever in Swinton and Pendlebury.

remaining cases in connection with articles of food. For example, the supply of milk to the invaded houses was in the hands of no fewer than 16 purveyors, the majority of whom obtained their milk from separate sources. Questions were asked as regards such food as oysters, but nothing in common in this connection was found. Likewise, there was no special incidence upon houses drained to any particular sewer outfall. Of the houses invaded, 25 were provided with privies, 5 with "pails," and 16 with water closets. In some of the latter houses, gross sanitary defects had been discovered in connection with the water closets or the drains.

All the invaded houses were supplied with water from the town mains except one, the occupiers of which had also obtained such water, their own supply derived from a well on the premises being said to be unfit for use. This community of circumstance is consistent with the disease having been water-borne ; but, except, perhaps, in one respect, there is little in the history of fever in Gainsborough either during the limited period now under review, or during the past 10 years, to suggest, *primâ facie*, that drinking water had large concern in its prevalence. The disease has appeared to a remarkably even extent year by year, without special outbursts on a large scale with intervening periods of comparative freedom such as might have been expected had the principal agent of fever diffusion been water. Moreover, although after 1889 water from the deep well was regularly supplied to the town, there has been no diminution of fever since that year. If the experience of 1898 and the year immediately preceding, so far as is shown by the cases which are known to have occurred, may be taken as a guide, it serves to indicate that the disease is ever present to some extent, with a seasonal tendency to increase in amount during the autumn and winter months. This tendency, which is confirmed, generally, by the experience of medical practitioners in the town, also points here to causes other than the public water supply.

If it be assumed that the water supply has had no part in Gainsborough in the causation of fever, it must be confessed that the other conditions which might be regarded as responsible for the fostering of this disease could hardly be more numerous or more highly developed. The principal method of excrement and refuse disposal already described, the inefficient drainage of dwellings in the "yards," the innumerable other filth and manure nuisances, and the inadequate and defective sewers and house drains, together with the dangerous conditions attaching to the sewer outlets, provide means for pollution of the soil with filth to an extent which, in the aggregate, must be very large indeed. At the same time facilities for the addition of actually infected matter to such polluted soil could scarcely be greater than at Gainsborough, for no steps have been taken to exclude the infective discharges of persons ill with fever from the middens or from any of the other above channels for the contamination of the soil. Although it is not in the nature of things possible to state exactly how many cases have occurred during the last decade to produce the fever mortality which has been witnessed, it may be fairly assumed that there must have been not fewer than 450 to 500 sufferers, distributed no doubt all over the town. The magnitude of the unchecked addition to Gainsborough soil of specific infective matter may be deduced from this estimate. And, as in the light of recent researches, it would appear that the micro-organism of typhoid fever is able to multiply and flourish in soil which is contaminated with organic filth, the facilities for soil pollution *plus* contamination with infective matter, such as exist uncontrolled in Gainsborough, become very important and may readily account for the persistence there of this preventable disease. Corroborative of this, to some extent, is the tendency which the fever appears to possess of showing itself rather more in those parts of the town where the faulty system of excrement disposal might be expected to cause a maximum pollution of the soil—such as where the midden privies are the most abundant and spread over the widest area—than in those places, the "yards" for example, where these appliances are localised, and are provided on the smallest scale. Recurrence of the disease in particular houses, though occupied by different families, points in the same direction.

But, on the other hand, the invasion of recently built houses in the outlying portions of the town seems at first sight to point to a source of infection not connected with soil pollution, although the neglect of the Council to require

impervious foundations, or to see that house drains are free from leakage, has resulted in facilities being provided even in the newest houses for soil pollution to an extent sufficient perhaps to explain the occurrence of this disease in them. Still the question does arise in connection with this feature of the case, whether the water supply may not have been responsible to some extent for the fever witnessed. It has been shown that the town's supply consists largely of water presumably above suspicion as regards the causation of fever; but that, nevertheless, it has been practically always mixed with a more or less considerable amount of Trent water; in other words, water which has aforetime been demonstrated to have produced in other districts an excess of fever among those using it.* It has also been described how, on occasion, none but river water has been supplied to the town, and it is to be noted that, at the end of 1897, the supply was exclusively furnished from this source for an unusually long period. It may be contended that the increase of fever about that particular time was due to the latter circumstance; but there is no corroborative evidence of it. The increase, so far as is known, at any rate, was not so considerable as to place it entirely outside the influence of season on a place in which the disease is endemic. Moreover, it appears that there was no coincident occurrence of fever in the adjacent parish of Morton, the only place outside Gainsborough itself which is supplied with the town water. Yet it is, of course, possible that infection may have been water-borne to some extent, especially at those times when river water has been exclusively delivered in the town. At any rate, having in view the proximity of the sewage outfalls to the intake, as well as the strong tidal action of the river, and having regard also to the fact that when the river serves as the sole source of supply, the water has to be hurried through the subsiding tank and filtering beds so quickly that, when drawn off in the town, it often contains, it is said, much suspended matter and signs of visible life, it cannot be denied that the use of the Trent water at Gainsborough has involved a considerable amount of risk.

But whatever the actual cause or causes of fever in the place may have been, the fact remains that Gainsborough has for long been a fever-stricken town, to an extent which is not only in excess of what might have been fairly anticipated in a comparatively small place of some 18,000 people, but is also in excess of what is known to have obtained in the case of those great cities and towns where very much greater populations are gathered together. The facilities for the maintenance, and it must be added for the unchecked spread of enteric fever, apart from water supply, are indeed so superabundant in Gainsborough, that it is matter for surprise that this disease has not shown itself to an even greater extent than it has. But if freedom so far from serious calamity be a matter for congratulation, it should also be a matter of the gravest concern that, instead of a tendency of the fever to diminish in amount, there is, on the contrary, a tendency to increase, and that the disease also occurs even in recently-built houses.

Conclusion.

The principal lesson to be derived by the inhabitants of Gainsborough from the persistence of fever in their town is the necessity for cleanliness in their surroundings. The neglect of this essential has already had grave results, while if it be continued the mischief will doubtless increase in something like geometrical progression, and at any moment may lead to disastrous consequences.

Everything that is possible should therefore be done by the District Council to bring about the cleansing of the compromised soil of the town, and to this end steps should at once be taken to substitute an adequate and efficient system of sewers for the existing defective and dangerous drainage arrangements. A new system should be so designed and carried out that the flow of sewage may be free and rapid at all times, and for this reason, just as much as for putting an end to the pollution of the Trent, there should be no direct connection of the sewers with that river. At the same time, the Council should aim to secure the abandonment of the privy midden system, and, as it is anticipated

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* Dr. Bruce Low has shown in his report on the River Trent, that during the 4½ years ended June 1893, the attack rate from fever per 1,000 living among the inhabitants of 8 villages in the Gainsborough Rural District who used the river water for drinking purposes was 7·3, as compared with 0·54 among those of 41 villages who did not use such water.

that there will very soon be a plentiful supply of water, there need be no obstacle to the universal adoption of the water-carriage system. Where middens and privies are abolished, their sites and the soil in their neighbourhood should be thoroughly cleansed.

Systematic and sustained inspection of the district is also essential, in order to improve the dwellings of the working classes, especially those of obsolete construction, and to seek out and ensure the removal of filth and other nuisances in the town. Repeated inspection, too, of new dwellings during construction is altogether imperative for every reason. There is, undoubtedly, plenty of scope for the improvement of the town by radical alterations of those parts specially crowded with dwellings, through the powers conferred by Parts I. and II. of the Housing of the Working Classes Act, 1890, and no time could be more favourable for schemes of this sort than the present, when so many "yard" houses are vacant. In any case, those dwellings which are so dilapidated or damp as to be unfit for habitation should be closed.

The Council should forthwith cease to deny themselves those sources of information and advice of which they have the power to avail themselves. Instead of continuing the appointment of the Medical Officer of Health on such terms that he can scarcely be expected to devote the time needed to adequately perform even his statutory duties, and still less those others which are commonly regarded as attaching to such a post, the Council should appoint him on such terms that he can do his work thoroughly, and, moreover, they should encourage him to do so. Similarly, an active, properly qualified Inspector of Nuisances, with adequate remuneration, should be appointed, and he should not be burdened with extraneous duties, such as that of supervising the scavengers' work. These officers, if appointed under proper conditions, should be constantly submitting information, such as will lead to full knowledge of the state of the town, of which it must be supposed that the Council have been hitherto in ignorance, for it cannot be credited that if such information had been regularly and repeatedly available, so little progress in sanitary improvement would have been made. The action taken by the Council in connection with the water supply is an instance of what they can do, in spite of sustained opposition, in a matter where knowledge as to the needs of the town has been obtained, and it justifies a hope that they will now turn their attention seriously to other shortcomings of the district.

As regards the neglect of the Council to adopt the Infectious Disease (Notification) Act, it should now be abundantly clear to them that it has had serious results. Publicity of the facts which it elicits is not, in practice, the outcome of its adoption. Even if such were the case, however, the Council should regard notification as providing an essential source of information without which the control of preventable disease, for which they are responsible in Gainsborough, is very seriously hindered. Just as preventable disease is a disgrace to a locality and to its governing body, so should it be superfluous in these days to recommend the adoption of this Act, for it enables the cause of such sickness to be sought out at once, and its power for further mischief to be possibly annulled. The Council should also cease to discourage the inhabitants from using their own hospital, for such is the practical effect of the tariff and conditions in force. They should, on the contrary, encourage its use by every means in their power, on the ground that isolation in such a building of persons suffering, through no fault of their own, from infectious disease, is necessary, not so much for the welfare of the sufferers, as for the protection of the community. The provision of an efficient disinfecting apparatus is also highly necessary, and, when provided, facilities for its use as a matter of routine would, no doubt, follow in due course, as well as the adoption of the various other preventive measures of an administrative character, which have been adverted to already.

I desire, in conclusion, to express my best thanks to Sir Hickman Bacon, the Lord of the Manor, to Mr. James Marshall, the President of the District Nurses' Association, to Mr. Dixon, the Chairman of the Urban District Council, to Mr. Horsley Wilkinson, the Medical Officer of Health, and to Mr. Riley, the Surveyor, for valuable information. To the latter and to Mr. Penny, the Inspector of Nuisances, I am also indebted, for assistance during my inquiry.

L. W. DARRA MAIR.

January, 1899.

APPENDIX 1.

General Statistical Information as regards Gainsborough Urban District.

Table A.—Number of Houses at the end of September, 1898, classified according to their rateable value, and their situation, together with the number of empty houses.

	North Ward.		Central Ward.		South Ward.		The District.	
	Houses.	Empty Houses.	Houses.	Empty Houses.	Houses.	Empty Houses.	Houses.	Empty Houses.
Rateable value not exceeding £8.	438	130	398	167	79	21	915	318
Rateable value exceeding £8, but not exceeding £18.	940		825		971		2,736	
Rateable value exceeding £18.	308		121		68		497	
Totals	1,686	130	1,344	167	1,118	21	4,148	318

Table B.—The Estimated Population, Registered Births, and Birth-rate per 1,000 living, Registered Deaths and Death-rate per 1,000 living from all causes, Deaths and Death-rate per 1,000 living from the seven principal zymotic diseases, and the Deaths of Infants under one year of age, together with the Infantile Death-rate per 1,000 registered births, in each of the years 1891 to 1897.

Year.	Estimated Population.	Births.	Deaths.	Deaths of Infants under 1 year.	Deaths from seven Zymotic Diseases.	Birth-rate.	Death-rate.	Infantile Death-rate.	Zymotic Death-rate.
1891... ...	14,450	520	254	82	25	36·0	17·6	158	1·73
1892... ...	14,910	478	239	78	18	32·1	16·0	163	1·21
1893... ...	15,380	530	307	89	44	34·5	20·0	168	2·86
1894... ...	15,880	551	240	87	18	34·7	15·1	158	1·13
1895... ..	16,380	564	289	120	40	34·4	17·6	213	2·44
1896... ...	16,900	491	262	80	20	29·0	15·5	163	1·18
1897.... ...	17,450	577	322	102	66	33·1	18·5	177	3·78

APPENDIX II.—Copy of Notice issued in Gainsborough in 1888, and in force at the present time—

GAINSBOROUGH LOCAL BOARD OF HEALTH AND URBAN SANITARY AUTHORITY.
HOSPITAL FOR INFECTIOUS DISEASES.

Scale of Charges.

Scale I.—For occupiers of houses rated above £10 per annum :—
Children under 5 years of age, 10*s.* per week.
Children 5 years of age and under 12, £1 per week.
Persons 12 years of age and upwards, £2 per week.

Scale II.—For occupiers of houses rated at or under £10 per annum, and for domestic servants, indoor apprentices, and shop assistants :—
Children under 5 years of age, 5*s.* per week.
Children 5 years of age and under 12, 10*s.* per week.
Persons 12 years of age and upwards, £1 per week.

The charges in each scale include hospital accommodation, food, nursing, medical attendance, and all other necessaries.

Patients who require a special medical man, will have his charges to pay.

Before the removal of any person to the hospital, a guarantee of payment must be given in writing by the occupier of the house in which the case occurs, or by some other responsible person.

By Order,

DECIMUS M. ROBBS, *Clerk.*

Gainsborough,

February 6th, 1888.

APPENDIX III.

CHEMICAL ANALYSES OF WATER DERIVED FROM NEW RED SANDSTONE AT GAINSBOROUGH.

A.

I forward herewith the result of the analysis of the water you submitted for examination. It contains 36·77 grains of solid matter per gallon, nearly the whole of which consists of the carbonates and sulphates of lime and magnesia with some chlorides of sodium and magnesium. As regards dissolved organic matter, the water must be regarded as one of great (almost exceptional) purity. The organic carbon is 0·044 parts per 100,000 parts (equal to 0·03 grains per gallon). The character of this organic matter is shown by the fact that 4·1000ths of a grain of oxygen only was consumed per gallon after three hours' action. The water contained no nitrogen as nitrates. It presents no indication whatsoever of previous admixture with sewage, or other contaminating matter. I desire, however, to call attention to the large quantity of magnesia present in the water (4·684 grains per gallon). This I consider in excess of that which is common in a water constantly used for drinking purposes.

Results of the analysis of a sample of water received from Dr. Mackinder, of Gainsborough, at the Laboratory of the London Hospital Medical College, Whitechapel, London, on the 18th day of August, 1888, and contained in glass-stoppered bottles duly secured, and without label :—

	Grains per gallon.
Total solid matter	36·77
Ammonia	0·003
Nitrogen in nitrate and nitrites	None
Oxygen required to oxidise the organic matter	0·004
	Parts per 100,000
Organic carbon	0·044
Organic nitrogen	0·024
	Grains per gallon.
Lime (Ca0)	9·18
	Grains.
Magnesia (Mg0)	4·684
Sulphuric anhydride	11·78
Chlorine	2·232
Common salt	3·658

	Degrees.
Hardness before boiling	26·00
Hardness after boiling	13·4
Silica	0·64

Very slightly turbid ; no odour on boiling ; very slight alkaline reaction.

The water has 26 degrees of hardness (active). This must be regarded as a somewhat hard water for domestic use.

Yours faithfully,

(Signed) C. M. TIDY.

August, 1888.

B.

Herewith I enclose the results of the complete analysis which I have made of the sample of water sent by you from the deep boring in the New Red Sandstone at Gainsborough. This water is palatable, and contains only a trace of organic matter ; it is also entirely free from even any suspicion of previous contamination with sewage or other refuse animal substances. It is, therefore, a water eminently free from all risk of communicating zymotic disease. The only drawback attaching to this water is its great hardness, which renders it unsuitable for washing and steam purposes. The hardness is, however, to a great extent of the kind known as "temporary," and could, therefore, be removed by treatment with lime ; such treatment would in fact reduce the hardness nearly to one-half of its present amount, and it would then not exceed that of ordinary London water. It must be pointed out, however, that a considerable part of this hardness is due to magnesia, the presence of which is sometimes regarded as objectionable in drinking water. There is, however, little or no evidence that such is the case, and, although I should prefer a water containing less of this ingredient, still the unimpeachable character of the water, as regards animal contamination, renders it difficult in any respects to be surpassed as a drinking water. It is unfortunate that the ordinary process of lime treatment would only remove a very small proportion of the magnesia in the present instance.

With regard to the question whether the water is exclusively derived from the Bunter Beds at the bottom of the boring, or whether contributions are also received from the upper or marly beds through imperfections in the bore-pipe, it is very difficult to form an opinion. I am, however, acquainted with the composition of water from two borings at Worksop, which lies on the Bunter Beds, and these waters have much the same composition as the present sample, so there would appear to be no reason for believing that the water is specially derived from the upper beds. It is, however, impossible to give a decisive judgment on this subject from the result of a single boring, as the hardness of the new red sandstone waters is very variable, even in the case of wells sunk at comparatively short distances from each other.

In conclusion, I may say of this water—

(1.) That as regards freedom from organic matter and from evidence of animal contamination, it cannot be surpassed.

(2.) That in its present condition it is very hard, and that after treatment with lime it would still remain a hard water, although the hardness would be thereby reduced to about one-half of its present amount.

(3.) That the proportion of magnesia may be objected to, but that this objection could only be justifiably pressed if another water of practically equal organic purity and containing little or no magnesia were to be substituted for this.

Results of Analysis expressed in Parts per 100,000.

Sample of water from boring in the new red sandstone at Gainsborough, August 1888 :— Total solid matters, 49·97 ; organic carbon, ·028 ; organic nitrogen, ·008 ; ammonia, 0 ; nitrogen as nitrates and nitrites, 0 ; total combined nitrogen, ·008 ; chlorine, 2·0. Hardness :—Temporary, 16·8 ; permanent, 18·6 ; total, 35·4.

Remarks.

Very slightly turbid, palatable, no poisonous metals.

The mineral matter was composed of the following ingredients :—Silica, ·94 ; oxide of iron and alumina, ·19 ; lime (present as carbonate), 8·81 ; lime (otherwise combined), 3·13 ; total, 11·94. Magnesia (as carbonate), ·59 ; magnesia (otherwise combined), 5·38 ; total, 5·97. Soda, 2·84 ; chlorine (combined as chlorides), 2·00 ; sulphuric acid (combined as sulphates), 16·62. These acids and bases may be combined together so as to form the following salts, &c. Silica, ·94 ; oxide of iron and alumina, ·19 ; carbonate of lime, 15·73 ; sulphate of lime, 7·60 ; carbonate of magnesia, 1·24 ; sulphate of magnesia, 16·14 ; chloride of sodium, 3·29 ; sulphate of soda, 2·49.

N.B.—The figures in the above table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left ; the same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

(Signed) PERCY F. FRANKLAND.

September 11, 1888.

C.

Herewith I enc ose the results of analysis of the sample of water sent by you from the boring into the N w Red Sandstone at Gainsborough. This water, although turbid, is palatable, and contair s only a very small proportion of organic matter, whilst it is also entirely free from any evidence of previous contact with sewage or other animal refuse.

The hardness is considerable, but by no means excessive, and although a water containing less saline matter in solution would doubtless be preferable on general grounds if it could be procured, there is no reason to believe that this water will not prove perfectly wholesome for dietetic purposes, whilst there is, of course, no comparison between the fitness of this water and the polluted river water which I analysed for you some years ago.

As the hardness of this water is principally of the kind known as temporary it is well adapted for artificially softening by treatment with lime (Clark's process), which would greatly enhance its value for washing steam purposes.

RESULTS OF ANALYSIS EXPRESSED IN PARTS PER 100,000.

Description.	Total Solid Matters.	Oxygen consumed (Kjeldah).	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Hardness.			Remarks.
								Temporary.	Permanent.	Total.	
Gainsborough Water Supply from boring in the new red sandstone, September 1893.	59·50	·039	·016	·001	·004	·021	2·3	14·0	8·4	22·4	Turbid, palatable, no poisonous metals.

(Signed) PERCY F. FRANKLAND, Ph.D., B.Sc., F.R.S.

September, 1893.